

Remarks

Claims 13-27, 29-32, 35 and 41 were presented for examination. Claims 13-27, 29-32, 35 and 41 were rejected. By this response, claim 13 has been amended. No new matter has been entered as support for the amendments is provided for by the specification, claims, and drawings as originally filed. Accordingly, claims 13-27, 29-32, 35 and 41 are pending in this application.

Rejections Under 35 U.S.C. § 112

Claims 13-27, 29-32, 35 and 41 were rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. In addition, claims 13-27, 29-32, 35 and 41 were rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for providing first lands that align with second lands but do not align with second channels in one embodiment such as illustrated in figure 4, does not reasonably provide enablement for the combination of the embodiment from figure 4 with the embodiment of figure 6.

Claim 13 has been amended to comply with the written description and enablement requirements. Namely, claim 13 has been amended to recite "an adjacent pair of said first lands and an associated one of said second lands are each provided in a pattern of alternating angles and crests in a plane parallel to both of said flow field plates, said pattern of said adjacent pair of first lands and said pattern of said associated one of said second lands are orientated relative to each other across the membrane electrode assembly such that said adjacent pair of said first lands and said associated one of said second lands crisscross along said alternating angles and alternate crests of said adjacent pair of said first lands aligning in cross section with a crest of said associated one of said second lands and then a crest of one of said adjacent pair of said first lands aligning in cross section with one of said plurality of second channels." Support for this amendment can be found in Figs. 4 and 6 and in paragraphs [0036] - [0041] and [0043] - [0045]. Figure 6 is reproduced below to show that that claim 13 is claiming both the pattern of a multiple of alternating angles (Fig. 6) and the pattern of the first lands with the second lands and not aligning with the second channels (Fig. 4) as is apparent along the vertical line A. As illustrated in Figure 6 along line A, the crests of an adjacent pair of the first lands align with the crest of the associated one of the second lands. In addition, as illustrated in Figure 6 along line B, the crest of

one of the adjacent pair of the first lands aligning cross section with one of the plurality of second channels. In other words, the crests of the adjacent pair of the first lands alternate between both first lands of the pair aligning with the crest of an associated one of the second lands and one of the adjacent pair of first lands aligning with the crest of an associated one of the second lands and the other one of the adjacent pairs of first lands aligning with one of the plurality of second channels.

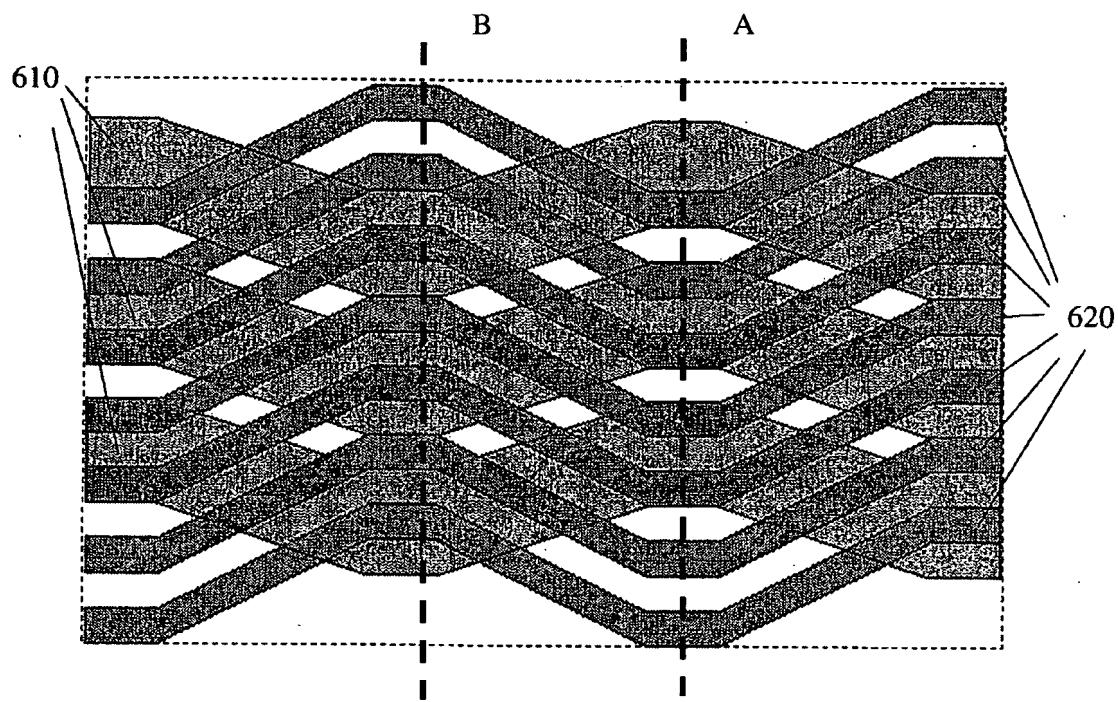


FIG. 6

Therefore, Applicant believe claims 13-27, 29-32, 35 and 41 do comply with the written description and enablement requirements and the Applicants request the withdrawal of the rejection to claims 13-27, 29-32, 35 and 41.

Claims 13-27, 29-32, 35 and 41 were rejected under 35 U.S.C. § 112, second paragraph as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicants regard as the invention.

Claim 13 has been amended to provide clarity for the indicated subject matter. Namely, claim 13 has been amended to recite "an adjacent pair of said first lands and an associated one of said second lands are each provided in a pattern of alternating angles and crests in a plane parallel to both of said flow field plates, said pattern of said adjacent pair of first lands and said pattern of said associated one of said second lands are orientated relative to each other across the membrane electrode assembly such that said adjacent pair of said first lands and said associated one of said second lands crisscross along said alternating angles and alternate crests of said adjacent pair of said first lands aligning in cross section with a crest of said associated one of said second lands and then a crest of one of said adjacent pair of said first lands aligning in cross section with one of said plurality of second channels." As discussed above, support for this amendment can be found in Figs. 4 and 6 and in paragraphs [0036] - [0041] and [0043] - [0045]. Therefore, Applicants believe that claims 13-27, 29-32, 35 and 41 are no longer indefinite and request the withdrawal of the rejection to claims 13-27, 29-32, 35 and 41.

Claim Rejections - 35 USC § 103

Claims 13-22, 31 and 41 were rejected under 35 U.S.C. 103(a) as being unpatentable over Grehier (US 4,037,023) in view of McLean (US 6,544,681). Applicants respectfully traverse.

Claim 13 recites a device comprising an electrochemical cell. The electrochemical cell comprises a membrane electrode assembly defining an anode side of the cell and a cathode side of the cell and a first flow field plate for the cathode side of the cell. The first flow field plate comprises a plurality of first channels separated by first lands. The plurality of first channels and first lands run between a first set of fluid manifolds. The electrochemical cell also comprises a second flow field plate for the anode side of the cell. The second flow field plate comprises a plurality of second channels separated by second lands. The plurality of second channels and second lands run between a second set of fluid manifolds. The membrane electrode assembly is interposed between the first and second flow field plates. A pitch is defined by the first flow field plate being less than a pitch defined by the second flow field plate. An adjacent pair of the first lands and an associated one of the second lands are each provided in a pattern of alternating angles and crests in a plane parallel to both of the flow field plates. The pattern of the adjacent pair of first lands and the pattern of the associated one of the second lands are orientated relative to each other across the membrane electrode assembly such that the adjacent pair of the first

lands and the associated one of the second lands crisscross along the alternating angles and alternate crests of the adjacent pair of the first lands aligning in cross section with a crest of the associated one of the second lands and then a crest of one of the adjacent pair of the first lands aligning in cross section with one of the plurality of second channels. The pitch of each the first and second flow field plates is constant between the first and second sets of fluid manifolds.

Grehier discloses a fuel cell formed from a stack of electrodes. However, in Grehier, the formed parts are the electrodes (Col. 2, lines 39-41), while in the claimed invention, it is flow field plates that are formed. Additionally, in Grehier, the electrode pattern formations are used to support a flow passage (Col. 2, lines 46-54; Col. 4, lines 9-17 and lines 57-62) of liquid electrolyte (Col. 1, lines 52-57; Col. 4, lines 9-17) or reactants (Col. 2, lines 46-48; Col. 4, lines 59-62). In contrast, in the claimed invention, a solid electrolyte is used and the offset pattern of the lands and channels of the flow field plates is used to avoid nesting of channels across the MEA. In other words, the protrusions of the two flow fluid plates, in the claimed invention, are offset across an MEA. Additionally, in Grehier, the crests of the lands of the serpentine electrode plates never align and, instead, the crests of the two plates form a chevron pattern when the electrode plates are stacked (Fig. 9). This is in contrast to claimed invention where an adjacent pair of land crests of one flow field plate periodically align with an associated one of land crests of a second flow field plate while not aligning with the channels of the second flow field plate. Further, Grehier fails to disclose flow field plates where a first flow field plate has a different pitch than a second flow field plate and where the lands and channels of the flow field plates align in a wiggle pattern on opposite sides of a MEA.

Examiner admits Grehier fails to teach that a pitch defined by one flow field plate is greater than a pitch of the other, or any details outlined in the above listed dependent claims with regards to the pitch and the cross-sectional dimensions, or that the fuel cell is a proton exchange membrane fuel cell and cites McLean. However, McLean fails to remedy the deficiencies of Grehier. McLean discloses a double sided corrugated flow field plate for use in fuel cells. However, McLean fails to teach an adjacent pair of the first lands and an associated one of the second lands are each provided in a pattern of alternating angles and crests in a plane parallel to both of the flow field plates. The pattern of the adjacent pair of first lands and the pattern of the associated one of the second lands are orientated relative to each other across the membrane electrode assembly such that the adjacent pair of the first lands and the associated one of the

second lands crisscross along the alternating angles and alternate crests of the adjacent pair of the first lands aligning in cross section with a crest of the associated one of the second lands and then a crest of one of the adjacent pair of the first lands aligning in cross section with one of the plurality of second channels. In McLean, the use of bi-polar plate flow plates with different pitches, as shown in Fig. 3, would result in the narrow lands (element 36 in Fig. 3) aligned with channels across the MEA resulting in the MEA shearing as the lands nested into the channels in plates across the MEA. In contrast, in the claimed invention, the out-of-phase angle (wiggle) pattern across the MEA helps eliminate the nesting problem and the shearing of the MEA (see paragraphs [0043] - [0045] of the claimed specification. Therefore, neither Grehier nor McLean disclose these limitations in the claimed invention.

Nor does the hypothetical combination of Grehier and McLean suggest or teach an adjacent pair of the first lands and an associated one of the second lands are each provided in a pattern of alternating angles and crests in a plane parallel to both of the flow field plates. The pattern of the adjacent pair of first lands and the pattern of the associated one of the second lands are orientated relative to each other across the membrane electrode assembly such that the adjacent pair of the first lands and the associated one of the second lands crisscross along the alternating angles and alternate crests of the adjacent pair of the first lands aligning in cross section with a crest of the associated one of the second lands and then a crest of one of the adjacent pair of the first lands aligning in cross section with one of the plurality of second channels. Because the hypothetical combination of Grehier and McLean does not suggest or teach all the limitations of the claimed invention, Applicants believe that claim 13 is patentable over the prior art and request the Examiner withdraw his rejection to claim 13.

Claims 14-22, 31 and 41 depend from the independent claim 13 either directly or ultimately. These dependent claims are patentable for the same reasons as presented above with respect to the claims from which they depend. Therefore, Applicants asserts that claims 14-22, 31 and 41 are also patentable over the prior art and request the withdrawal of the rejection thereof.

Claims 23-27, 29, 30, 32 and 35 were rejected under 35 U.S.C. 103(a) as being unpatentable over Grehier in view of McLean as applied to claim 13 above, and further in view of Suzuki (US 2002/0004158). Applicants respectfully traverse.

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Claims 23-27, 29, 30, 32 and 35 depend from the independent claim 13 either directly or ultimately. These dependent claims are patentable for the same reasons as presented above with respect to the claims from which they depend. Therefore, Applicants assert that claims 23-27, 29, 30, 32 and 35 are also patentable over the prior art and request the withdrawal of the rejection thereof.

Conclusion

In view of the above amendments and remarks, Applicants respectfully submit that the present application is in condition for allowance. The Examiner is encouraged to contact the undersigned to resolve efficiently any formal matters or to discuss any aspects of the application or of this response. Otherwise, early notification of allowable subject matter is respectfully solicited.

Respectfully submitted,
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